REMARKS

Claims 7-9 and 49-120 remain in the application. Claims 1-6 and 10-48 have been previously cancelled. Claims 7-9, 49-59 and 94-103 are withdrawn from consideration as being directed to non-elected inventions. Claims 60-93 and 104-120 are directed to the elected invention.

Claims 87, 107, 108, 115 and 118 have been rejected under 35 U.S.C. § 102(b) as being anticipated by Todd ("A Compatible Digital Audio Format for Broadcast and Cable Television). Claims 60-86, 88-93, 104-106, 109-114, 116, 117, 119 and 120 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over the prior art as illustrated in Fig. 1 in view of Holt et al (US Patent No. 4803727). These rejections are respectfully traversed and reconsideration is requested in view of the forgoing amendments and following remarks.

The pending elected claims 60-93 and 104-120 are directed to systems and methods of various aspects of processing audio signals in digital form in accordance with the BTSC standard. In 1996 (when the application having the earliest priority date claimed in the present application was filed) digital generation of the conditioned sum and difference signals (or "digital BTSC compliant L+R signals" and "digital BTSC compliant L-R signals") prior to modulation was not straight forward for many reasons. At the time of filing of the first application (1996), digital signal processing was still a relatively new and expensive technology, especially for consumer applications. Analog BTSC encoders prior to the present invention were quite complex, employing unusual non-linear analog devices such as log-based rms-level detectors and exponential-responding voltage-controlled amplifiers. The spectral encoder, especially, was formed by way of both feed-forward and feed-back paths around one such voltage-controlled amplifier, resulting in an even more complicated signal processing element whose functionality is difficult to simulate, much less implement in real time within the digital domain. Indeed, so great are the processing requirements of a digital BTSC encoder that it was simply not possible to implement the device on a single Motorola 56002 – the state of the art in digital signal processor (DSP) devices at the time – and the initial commercial product employing the claimed subject matter of the present application employed a second on-board digital signal processor. Analog-to-Digital conversion was much less widely used at that time and the available converters were not as capable or as economically feasible as is true today. It

is respectfully submitted, therefore, that a DSP could not be reasonably and successfully employed to replace the type of complex analog functions required by an analog BTSC encoder such that it would have been obvious to one skilled in the art at the time the present invention was made.

In addition, it is submitted that the task of creating a digital equivalent for the analog adaptive signal weighting system required by and defined in the BTSC standard is less than straightforward, and in fact applicant found creating a digital equivalent was quite challenging at the time the present invention was made. This difficulty also applies to creating a digital equivalent of the analog double sideband suppressed carrier amplitude modulator. These difficulties are a result of the original specification of the BTSC standard, which was developed with the assumption that the specification was to be implemented using continuous-time analog systems (represented in the "s-plane" of real and imaginary frequencies), and not on the basis of sampled data systems (which are represented in the "z-plane"). As is well known in the theory of sampled data systems, transforming a given analog filter (as defined in the s-plane) to a sampled equivalent (in the z-plane) inevitably involves some warping of the amplitude and phase characteristics of the filter, which warping becomes more pronounced as frequency increases closer to the sample rate. In practical systems, especially systems which are limited in computational power such as were prevalent at the time of the present invention, this warping presents a significant obstacle to proper performance of a digital BTSC system. Any variations in phase and amplitude response of a digital BTSC encoder from the ideal analog specification will cause phase, amplitude, and separation errors in the signal as demodulated and decoded in even an ideal analog receiver. This applies as well to an analog BTSC encoder paired with a digital BTSC decoder. An important aspect of the design approach described in the above-identified application was managing the inherent warping in transforming from the s-plane to the z-plane such that the digital BTSC encoder could freely be substituted for an analog BTSC encoder without requiring corresponding changes in the BTSC decoder (whether analog or digital). While various solutions to minimizing or even eliminating this inherent warping have evolved since the time the present invention was made, such warping was nevertheless an inherent impediment to a digital solution, and not the least bit straight forward.

Another impediment to applicant's creation of a digital equivalent of the analog BTSC adaptive signal weighting system is the fact that the BTSC system can be regarded as a signal-

dependent time-varying "filter," whose amplitude and phase response varies based on the recent history of the signal being processed itself. The fact that this "filter" varies over time based on the content of the signal significantly complicated the proper construction of a digital equivalent, since not only is it required that the digital "filter" precisely mimic the characteristics of the analog BTSC-defined prototype under one set of input signal conditions, but that the digital "filter" mimic those characteristics under all possible input signal conditions, at any point in time. As those skilled in the art are aware, it is much more difficult to properly warp a sampled-data system to match a continuous-time prototype if the system must vary its characteristics over time.

REJECTION OF CLAIMS 87, 107, 108, 115 AND 118

With regard to the rejection of claims 87, 107, 108, 115 and 118 under 35 U.S.C. § 102(b) as being anticipated by Todd ("A Compatible Digital Audio Format for Broadcast and Cable Television), it is submitted that Todd does not anticipate the invention as claimed. In rejecting claims 87, 107 and 115, the Examiner states, "Todd discloses a system (see Fig. 5) for producing a digital composite modulated BTSC signal ..." This is, however, simply not true. In fact, what Todd discloses is a method of *adding* a new (digital) signal not contemplated by the original BTSC specification, which new signal conveys digital audio information along with the conventional <u>analog</u> BTSC signal. This new signal is separate and different from the analog BTSC signal, and clearly not a part of the BTSC standard. In Figure 5 of the cited reference, the only digital portions of the system shown are contained in the "QPSK Mod" block. This block is in a separate signal path from the BTSC encoder, and does not contain any BTSC encoder whatsoever. The "BTSC Encode" block does not contain any digital portions at all (unlike the present application). In order to understand this fact, it is necessary to read the accompanying text carefully.

The Examiner's attention is directed to section IV, starting on page 300 of the referenced article. In the first paragraph of this section, Todd writes: "... the effect of the *new* digital signal on the BTSC audio will be one of additive noise." (Emphasis added.) By characterizing the "digital signal" as "new", this sentence indicates that the "BTSC audio" portion of the signal (generated in the "BTSC Encoder" block of Fig. 5) continues to exist unchanged from the prior state of the art alongside the *new* digital processing portion; no digital circuitry whatsoever is

indicated in the BTSC Encoder. Moreover, it is clear that the "new digital signal" Todd references is contained entirely within the *added* "QPSK Mod" block. As is clear to one skilled in the art, QPSK is not a part of BTSC, nor is there any teaching within Todd which shows how to incorporate BTSC within the "QPSK Mod" block.

Further evidence for this interpretation is found in the fourth sentence of this same paragraph, in which Todd writes: "Testing for BTSC compatibility involves measuring the additional noise caused by the *new* signal." (Emphasis added) Here again, Todd mentions a *new* signal (referring to the new digital one that his system generates in addition to the original -- analog -- BTSC signal) not a new method of creating the BTSC signal. In fact, the entire purpose of the compatibility testing of which he speaks is to understand whether this new, separate, digital signal interferes with the existing, separate, analog BTSC signal.

Even further evidence for this interpretation of the reference is found in the sixth sentence of this same paragraph, in which Todd writes: "Channel 3 is outfitted with BTSC stereo and SAP and with the *new digital* carrier." (Emphasis added.) Here yet again, Todd refers to the "new" carrier, this time making explicit that it is a digital carrier, separate from the (existing) analog BTSC carrier. From the fact that Todd describes only the new carrier, and not the analog BTSC carrier, as "digital", he is stating that he contemplates no change to the status quo, that of a BTSC carrier generated in the customary fashion at the time (1987) -- by analog methods. Thus, Todd is preserving the analog BTSC signal, while introducing a new non-BTSC digital signal. One has to ask oneself the following question: if Todd was contemplating a digital implementation of the additive signal, why didn't he extend the digital implementation to the analog BTSC signal? Applicant interprets this fact as evidence that Todd believed that the BTSC standard would be, at best, extremely difficult, if not impossible at the time to implement digitally, and instead of following that path, created a completely separate and distinct signal to be added to the existing TV channel spectrum to contain digital audio signals..

In Figure 6, Todd shows the RF spectrum of the signal generated by the system of Figure 5. In the caption for Figure 6, Todd identifies the major components shown in the spectrograph as "Ch3 vision carrier, color subcarrier, *FM sound carrier*, QPSK data carrier, and CH4 vision carrier." (Emphasis added.) As is clearly understood by those skilled in the art, the BTSC information is contained exclusively within the FM sound carrier. Todd's new digital sound system is contained exclusively within the QPSK data carrier. BTSC, and Todd's new proposed

system, are separate and distinct. In no way is Todd attempting to show a method of generating the BTSC signal digitally; instead, he shows a method of *adding* a *separate* carrier (the QPSK data carrier) which carries digital data.

Next, the Examiner goes on to say that the BTSC signal comprises "a *digital* BTSC encoder arranged so as to generate a *digital* BTSC encoded signal, and a digital composite modulator." (Emphasis added.) The Examiner refers to Figure 5 in Todd to support this description. Again, absolutely no support can be found in the reference for the Examiner's position that Todd ever mentions or indicates, let alone teaches or anticipates, a *digital* BTSC encoded signal.

Figure 5 of Todd, in fact, shows a conventional *analog* BTSC encoder arranged so as to generate an *analog* BTSC encoded signal. This analog BTSC signal feeds an *RF* modulator ("Ch3 Mod"), not a "digital composite modulator" as proposed in the present invention, and so, further, the Examiner is incorrect in stating that "Todd shows the [digital composite] modulator coupled to the BTSC encoder and generates the digital composite modulated BTSC signal."

What Todd's Figure 5 does show is a test configuration intended to demonstrate that his new QPSK-modulated digital signals do not interfere with existing *analog* BTSC signals. As is made clear from the accompanying text, the BTSC encoder shown in Todd's Figure 5 is a conventional *analog* BTSC encoder. Todd's new digital signals are generated by the block labeled "QPSK Mod", and which are in a completely separate signal chain from the analog "BTSC Encode" block. Todd makes this clear in the first paragraph of Section IV where he states (referring to Figure 5), "[The] Channel 3 [modulator] is outfitted with BTSC stereo and SAP *and* with the new digital carrier." (Emphasis added). Clearly, Todd's new digital signals are in addition to, and not in replacement for, the analog signals generated by the "BTSC Encode" block.

To further illustrate that Todd is not discussing a digital BTSC implementation, the Examiner attention is directed to Todd's Figure 2. Here, the QPSK modulation scheme envisioned by Todd is laid out in more detail. As Todd explains in Section III, paragraph 1, the QPSK modulator block is in the form of "a pair of bi-phase modulators working in quadrature as shown in *Figure 2*." Certainly this block contains nothing that would provide the sophisticated signal processing required to encode -- digitally or otherwise -- an audio signal according to the BTSC standard. As is understood by one skilled in the art, a bi-phase modulator does not

contain variable-gain amplifiers, spectral encoders, rms-sensing level detectors, or elaborate digital filters which mimic specific analog prototypes (all elements required by the BTSC system as specified). Nor does bi-phase modulator contain an adaptive signal weighting system capable of modifying the phase and amplitude of signals in accordance with the BTSC standard. Nor does a bi-phase modulator contain an double-sideband suppressed-carrier amplitude modulator, as required by the BTSC system specification. Nor does a bi-phase modulator contain a frequency modulator of the type specified by the BTSC system.

The only other place in Todd's system where such processing could occur is in the analog-to-digital conversion which results in the two "Data" streams shown in Figure 2. However, Todd makes it clear in Section II, Paragraph 2, that he is proposing to use an "advanced form of adaptive delta-modulation sound coding". As is known by one skilled in the art, delta-modulation is a technique for converting an analog signal to a digital signal, and is not a system which could provide BTSC signal processing. A delta modulation sound coder does not contain a variable-gain amplifier, spectral encoder, rms-sensing level detector, or elaborate digital filters which mimic specific analog prototypes (all elements required by the BTSC system as specified). Nor does a delta modulation sound coder contain an adaptive signal weighting system capable of modifying the phase and amplitude of signals in accordance with the BTSC standard. Nor does a delta modulation sound coder contain an double-sideband suppressed-carrier amplitude modulator, as required by the BTSC system specification. Nor does a delta modulation sound coder contain a frequency modulator of the type specified by the BTSC system.

Therefore, it is respectfully submitted that there exists no block or combination of blocks as disclosed or envisioned by Todd which could be construed as a digital BTSC encoder.

It may be that the Examiner was confused by Todd's use of the word "compatible" as, for example, in Section 0 where she says "the new signal has been shown to be compatible with the BTSC stereo and SAP signals." Perhaps the Examiner interpreted this to mean that Todd's system generates a digital equivalent of a BTSC signal. If so, this would be a misinterpretation of Todd's disclosure. Todd makes it clear in several places that by "compatibility" he means that the new signal does not interfere with the existing, conventional, analog BTSC signal. He explicitly states this, in fact, in the first paragraph of Section II: "The most important requirement for the new system is ***compatibility***. *The new digital carrier must not interfere with*

*the **existing** vision or sound signals*" (Emphasis added). When Todd refers to the "existing … sound signal," he is referring to the existing BTSC-formatted sound information which is part of the original BTSC standard. It is clear that Todd's new digital signal transmits audio, but not within the BTSC format; instead Todd adds a separate path which provides a means for digital audio to be transmitted alongside the existing analog BTSC audio. His only concern with BTSC – indeed the only reason BTSC is mentioned in Todd's paper – is to demonstrate that the new QPSK digital signal he proposes will not spill over into, and thus interfere with, the existing conventional, analog BTSC signal.

The fact that Todd goes to all this trouble to create a separate system in order to add digital audio to the existing system further supports the difficulty --at the time -- of digitizing the BTSC system itself.

In addition, the Examiner states that "The demodulator inherently modifies the amplitude and phase of at least one of the digital audio signals in order to generate the separated L, R, and SAP." [Since the preceding sentence mentions only a modulator, and not a demodulator, and since Todd's Figure 5 (which is referenced by the Examiner in the preceding sentence) does not contain any blocks labeled or other references to a "demodulator", it is believed that the Examiner intended to refer to a "modulator," and applicant is responding in light of this understanding.] It is further believed that in this specific point, the Examiner is referring to claim 107, which recites "… c) modifying the amplitude and phase of at least one of the digital audio signals according to the BTSC standard so as to create one or more corresponding digital audio output signals according to such standard." The Examiner's attention is directed to the limiting phrase within the claim "according to the BTSC standard". While Todd may have intended to modify the amplitude and phase of a digital audio signal within the block labeled "QPSK Mod" in Figure 5. However, as pointed out earlier, there is no indication that Todd intended that any such modification of the amplitude and phase of such digital audio signal was in accordance with the BTSC standard. Applicant directs the Examiner's further attention to the block in Todd's Figure 5 labeled "BTSC Encode", which Todd clearly intended to be the whole and complete instance of BTSC encoding within Todd's disclosure. Furthermore, as argued previously, there is no suggestion whatsoever within Todd that said "BTSC Encode" block might be realized in digital form, nor is there any suggestion whatsoever within Todd that said "QPSK Mod" block might contain any BTSC signal processing. In fact, because Todd did not intend to,

nor does in fact disclose either a digital BTSC encoder or digital BTSC decoder, the Examiner's statement is inaccurate.

In section 2, Paragraph 4 of the Detailed Action, the Examiner rejects claims 108 and 118 under Todd, stating, "...the claimed carrier frequency is inherently included in the modulator performed according to the BTSC standard." While that may be so, the inclusion of a specific carrier frequency does create a valid and patentable limitation given that alternate carrier frequencies could be used while still adhering substantially to the principles of the BTSC standard. Furthermore, the matter of claims 108 and 118 refers to digital systems, not analog ones. Since the BTSC standard did not anticipate digital systems, it is respectfully submitted that a digital system using the claimed carrier frequency is not inherent in the BTSC standard.

On the basis of the foregoing it should be clear that, in fact, Todd had not anticipated a digital BTSC encoder, and that the Examiner's rejection of any claim in light of Todd is not, therefore, valid.

On a final note with respect to the Examiner's response, we point out that nowhere in Todd does the phrase "digital BTSC signal" or any permutation or variation of that phrase appear.

REJECTION OF CLAIMS 60-86, 88-93, 104-106, 109-114, 116, 117, 119 and 120

In section 4, Paragraph 2 of the Detailed Action, the Examiner rejects claims 60-86, 88-93, 104-106, 109-114, 116, 117, 119 and 120 under 35 U.S.C. § 103(a) as being unpatentable over the prior art as illustrated in Fig. 1 (of the present application) in view of Holt et al (US Patent No. 4803727). The Examiner states "Holt teaches that the analog band limiting filter would introduce noise to the signal and degrade the system performance", and further, that "Although Holt discusses the system used in the United Kingdom, one skilled in the art would have expected that the analog band limiting filter used in the United States would produce the similar effect." The Examiner concludes the paragraph by stating that "Thus, it would have been obvious to one of ordinary skill in the art to modify prior art as illustrated in Fig. 1 in view of Holt by implementing Fig. 1 using digital circuitry in order to eliminate the noise caused by the analog circuitry."

However, it is respectfully submitted that the Examiner is mistaken in asserting that Holt, when combined with applicant's Fig. 1 makes the present invention, as defined by claims 60-86,

88-93, 104-106, 109-114, 116, 117, 119 and 120, obvious. The Examiner, for example, states that "Holt teaches that the analog band limiting filter would introduce noise to the signal and degrade the system performance." While Holt mentions noise, the context and meaning of Holt's reference to noise is entirely different from that of a BTSC system and/or the present invention. Moreover, Holt does not actually claim or teach that the analog band-limiting filter introduces noise.

Referring to Holt in more detail, first Holt states (col 1, line 32) "the main disadvantage of such band-limiting systems is that the band-limiting low-pass filter introduces phase distortion into the difference signal relative to the sum signal, resulting in loss of stereo information." It is clear from this quote that Holt is not primarily concerned about noise, but phase distortion introduced (solely, as it turns out) into the difference signal. Holt then goes on to point out that an analog filter which provides a "corresponding phase compensation into the sum signal … causes, in turn, the introduction of noise… which leads to degradation of the system performance." The noise which Holt wishes to reduce here is that of a very specific type of analog filter – a phase compensation filter -- which filter is required as a result of the band-limiting low-pass filter in the difference signal path. It is not, after all, the analog band-limiting filter which introduces noise; Holt is concerned about noise introduced by the analog filter (phase-compensation filter) which compensates for the phase response of the band-limiting filter.

This distinction is important, since Holt's point about noise is raised repeatedly by the Examiner in reference to the filtering which Holt teaches, comparing that to what the Examiner compares to a similar objective of the present invention. As is appreciated by one skilled in the art, Holt was particularly interested in matching the phase response (delay, whether frequency-dependent or not) of the L-R bandlimiting filter with that of a complementary filter in the L+R signal path. However, Holt intended to maintain wide frequency response in the L+R signal path, which required the phase compensation filter to maintain substantially wider bandwidth than the L-R bandlimiting filter. For example, Holt says (col 1, line 40) "According to a first aspect of the present invention there is provided a transmission system for audio signals in which .. the difference signal is bandlimited to a predetermined bandwidth *smaller* than that of the monophonic signal…" (Emphasis added.) Clearly, Holt envisions a wider bandwidth for the L+R (monophonic) signal than for the L-R (difference) signal.

In fact, Holt envisioned using a very low bandwidth for the L-R bandlimiting filter, as low as 2kHz. Holt says (col 2, line 14) "According to a fourth aspect of the invention there is provided a transmission apparatus for stereophonic audio signals comprising ... means for bandlimiting the difference signal to *substantially 2kHz...*" (Emphasis added.) Even today, to compensate the phase response of such a low-frequency-cutoff filter with an analog compensation (all-pass) filter, requires many stages, each of which would add noise and degradation to the signal path. This is especially true since, following Holt's teaching, the L+R signal would be the only means of transmitting information in the frequency range above substantially 2kHz. This makes it important to maintain full bandwidth (known as all-pass response) in the L=R compensation filter. As will be appreciated by one skilled in the art, the greater the ratio between the cutoff frequency of the compensation filter (in this case, full audio bandwidth – likely up to 15kHz) and that of the low-pass filter whose phase response is to be compensated (in this case, significantly reduced bandwidth – preferably 2kHz according to Holt), the more stages which will be required to maintain proper phase compensation in the compensating filter. Also as is well known to practitioners of the BTSC art, which uses L=R and L-R techniques to encode and ultimately reconstruct separate L and R signals, phase differences in the L-R and L+R signal paths are particularly damaging to stereo separation of the ultimate L and R signals after decoding.

As will be appreciated by those skilled in the art, Holt is correct in asserting that the analog L-R (phase) compensation filter may well introduce noise and other signal degradations to the important L+R signal path. But, this situation simply does not apply to BTSC.

First, in the BTSC system, the bandwidth of the L-R signal path is essentially identical to that of the L+R signal path. In fact, BTSC was defined this way in the original specification at least partly to avoid the problems which Holt seeks to mitigate. As a result, there is inherently no need to compensate a low bandwidth L-R channel with phase delays in the L+R channel. To the extent that processing in the BTSC L-R channel causes differential delays with respect to that of the BTSC L+R channel, in the analog domain these delays are relatively minor and are easily compensated by relatively simple phase compensation networks, typically using two poles and two zeroes to maintain excellent separation to 15kHz, the practical limit of the BTSC frequency response. Such phase compensation networks introduce less noise and signal degradation in the

L+R signal path than is necessarily introduced by the analog signal processing required to implement the BTSC algorithms in the L-R signal path.

Moreover, as will be appreciated by those skilled in the art, the noise in the BTSC system stems primarily from limitations, theoretical and practical, to FM transmission systems. The noise of analog signal processing components, including those typically used to implement BTSC signal processing, and unlike the situation as taught by Holt, does not present a significant limitation in commercial, conventional implementations of BTSC compared to that of the FM RF transmission system which is an integral part of the BTSC system. This is because the self-noise of analog components which comprise a BTSC encoder is a vanishingly small component of the total noise induced by the transmission system. This was true when the BTSC system was first introduced in 1993, was true when the present application was first filed in 1996, and is still true to this day. This is particularly true of the L-R channel, where the most significant BTSC signal processing occurs. As stated in the present application: "the stereophonic [L-R] channel was necessarily located in a higher frequency region of the BTSC signal making the stereophonic channel much noisier than the monophonic signal." As a result, the noise of the stereophonic channel dominates the noise added by a BTSC encoder (analog or digital), rendering inconsequential the need to reduce or eliminate the self-noise of the analog components comprising it. This fact is not a result of using analog components, but inherent in the nature of the FM transmission system required by the BTSC standard.

The present invention does **not** change the transmission system employed for BTSC audio transmissions, but rather changes the nature of the processor which generates the FM signals themselves. Systems using the various claimed aspects will generate or receive FM signals which appear essentially identical to those generated or received by analog BTSC equipment – ultimately an analog signal.

Thus, while it is indeed an object of Holt's teachings to provide a means to reduce the noise and other potential signal degradation introduced by the analog L-R compensation filter, such reduction in noise is not needed for the BTSC system, nor is it a significant object of the various claimed aspects to reduce noise.

By contrast, the BTSC system reduces noise – in the RF channel – by dynamically compressing the L-R audio signal before transmission, and then dynamically expanding the L-R signal in complementary fashion after reception. The combination of dynamic-range

compression and complementary dynamic range expansion is well known to those skilled in the art, and is the essential element of the BTSC system which reduces noise. Again, it is noise in the transmission channel that BTSC seeks to reduce, not noise in the components which make it up. The various claimed aspects of the digital version of certain BTSC system components (though not a digital version of the BTSC's essentially analog RF transmission component) does not seek to reduce noise over BTSC's analog counterparts. Instead, the various claimed aspects of the digital systems retain all the essential noise-reducing attributes of the analog BTSC implementations, while improving on stability, precision, and ease of implementation as can be obtained by digital means.

Moreover, the BTSC system there does not contain a bandlimiting filter which is in any way analogous to that taught by Holt. Figure 1 of the present application shows a bandlimiter (124) in the L+R path, as well as an overmodulation protector and bandlimiter (138) in the L-R path. Neither of these bandlimiters are responsible for reducing noise in the systems. Their purpose is to ensure that the 15.734 kHz pilot signal (shown at fH in Figure 2 of the present application) does not suffer from interference as a result of audio signal frequencies in the vicinity of said pilot signal. As noted in the present application: ,

> The BTSC standard also provides guidelines for the operation of overmodulation protector bandlimiter 138 and bandlimiter 124. Specifically, bandlimiter 124 and the bandlimiter portion of overmodulation protector and bandlimiter 138 are described as low pass filters with cutoff frequencies of 15kHz, and the overmodulation protection portion of overmodulation protector and bandlimiter 138 is described as a threshold device that limits the amplitude of the encoded difference signal to 100% of full modulation...

Note that both bandlimiters are described as having the same cutoff frequency. Therefore the problem addressed by Holt, that of imposing a different phase response on the L-R channel from that of the L+R channel as a result of the much smaller bandwidth allowed for the L-R channel, does not exist in BTSC.

Moreover, neither of the bandlimiters shown in Figure 1 of the subject application are responsible for adding noise to the BTSC system in an analog configuration.

Another consideration is that the primary object of Holt's invention is to reduce the bit rate in a digital transmission system. This is evident from the following quote from Holt (col 1,

line 40): "According to a first aspect of the present invention there is provided a transmission system for audio signals in which at a transmitter: ...the sampling rate of the digital bandlimited difference signal is *reduced*..." (Emphasis added.) This reduction in sampling rate is important because it reduces the bandwidth needed to transmit the left and right signals through what is taught as a digital transmission path (18 in Holt's Figure 2). By using digital filter methods instead of analog filter methods, Holt is able to avoid the phase shift that inevitably occurs in analog filters, and which is undesirable in the particular system of L+R and L-R transmission which Holt teaches,(one wherein the L-R signal is bandlimited to a bandwidth substantially lower than that of the L+R signal). Consider Holt's statement (col 3, line 29): "It is relatively easy to construct digital filters having a constant delay response, so that the resultant relative delay, due to the bandlimiting of the difference signal... can be compensated..." As is well known to one skilled in the art, and has been explained above, even to this day such compensation is relatively easy to achieve in the digital domain, and relatively difficult in the analog domain, requiring elaborate filters which, as Holt states, may introduce noise and degrade the signal.

Holt teaches an analog matrix (1 and 2) coupled to a digital filtering system (13) combined with a digital transmission system (blocks 17 and 19 and the connection 18 between them), and a reciprocal series of digital upsamplers and analog matrix to recover a facsimile of the original input signals. The main benefit of the digital bandlimiting filters is to reduce the bandwidth of the signal, not to avoid noise that might be introduced by using similar bandlimiting filters executed with analog circuitry. Importantly, Holt's transmission system is entirely digital, as can be shown by his text "The sum and difference signals may then be multiplexed together in multiplexer 17 before transmission over the *digital transmission link* 18 to a receiver." (Col 3, line 4; emphasis added.) It appears that the Examiner agrees with this interpretation, as noted in the first paragraph on page 8 of the Examiner's response: "...Holt teaches the benefit of transmitting digital audio signal for TV broadcasting."

Comparing the BTSC system to Holt's disclosure, the BTSC system's purpose is to reduce noise that is introduced in an *analog* radio-frequency transmission system. As has been pointed out earlier, the original (prior art) BTSC realizations were made entirely of analog components; these were not responsible for significant compromises in the noise performance of the system, and it is not an object or even a benefit of applicant's BTSC system to reduce noise

in the circuitry, let alone in the analog filters. Instead, applicant's BTSC system replaces elements of the previously analog-only BTSC system with digital circuitry, increasing stability and convenience for modern systems which are increasingly made with digital circuitry. Notably, applicant's system does not seek to change in any way at all the analog FM radio-frequency transmission system used between broadcaster and receiver for the audio signals transmitted by this system.

The Examiner may have misconstrued the digital version of the BTSC system described and claimed in the present application as somehow producing a replacement digital transmission system which substitutes for the BTSC system's analog transmission system. (This is what Todd proposed in the reference cited by the Examiner.) Nothing could be further from the truth. The BTSC signal transmitted and received under the present application is purely analog. The signal transmitted and received by Holt is, as the Examiner correctly notes, a digital signal.

Applicant's system provides a way, using digital means, of creating an analog BTSC signal that is, other than with the improvements described with respect to stereo separation, component drift, etc., entirely equivalent to the conventional analog BTSC signal. It is not the output signal itself that is different at all, but only the specifics of how it is developed. As the Examiner correctly points out, "Holt teaches the benefit of transmitting digital audio signal for TV broadcasting." In the present application, the system provides the benefit of using digital technology to create a 'better' version of an analog audio signal for TV broadcasting, where the analog audio signal (as an audio subcarrier frequency-modulated with a complex L+R, L-R, and optional SAP signal) is essentially indistinguishable from and equivalent to the one produced by entirely analog means.

As well, the BTSC system of the present application does not reduce the bandwidth of the L-R channel, nor does it seek to differentiate said bandwidth from that of the L+R channel. This is a key component, in fact a key objective, of Holt.

Thus, a critical difference between the system described in Holt and that of the disclosed system is that Holt describes bandlimiting applied to the L-R channel of a digital transmission system, while the present application describes a method of realizing a full-bandwidth, analog BTSC transmission system using digital circuitry and techniques.

The Examiner goes on to say "Although Holt discusses the system used in United Kingdom, one skilled in the art would have expected that the analog band limiting filter used in

United States would produce the similar effect." While this may be an important factor with respect to Holt and systems which rely upon bandlimiting to reduce bandwidth (or, in the digital system bit rate) in the L-R channel, it is essentially irrelevant with respect to the BTSC system.

As was noted earlier, the BTSC system does not bandlimit the L-R channel differently from the L+R channel; this is an essential objective of Holt. In BTSC there does not exist an "analog band-limiting filter" as described in Holt which could produce a "similar effect" as stated by the Examiner. Furthermore, also as has been noted earlier, it is not actually the analog (L+R) band-limiting filter, but the phase-compensating (L-R) filter which Holt ascribes to having detrimental effects to the signal. As has been noted earlier, any analog band-limiting filters, as well as any analog phase-compensating filters used in the United States for the BTSC system do not have the effect of introducing noise to the overall system. The analog FM transmission system which is an inevitable and essential part of the BTSC system presents a far more significant limit to noise in the BTSC system performance. Thus, applicant respectfully submits that one skilled in the art would *not* have "expected that the analog band limiting filter" (or for that matter the analog phase-compensating filter) "used in the United States would produce the similar effect."

The Examiner's attention is drawn to the advantages cited in the present application for implementing the BTSC processors digitally. Specifically, in applicant's specification it is noted that analog BTSC encoders are "relatively difficult and expensive to construct"; that "due to the variability of analog components, complex component selection and extensive calibration have been required"; that there is a "tendency of analog components to drift, over time, away from their calibrated operating points"; and that they are "inconvenient to use with...digital equipment." Notable for its absence is any mention of the need or desire to reduce the noise of the analog components which comprise the prior art BTSC coder.

This is because, unlike Holt, the self-noise of analog components which comprise a BTSC encoder is a relatively small component of the total noise induced by the transmission system. As has been explained previously, this is particularly true of the L-R channel, where the most significant BTSC signal processing occurs. As noted in the present application, "the stereophonic [L-R] channel was necessarily located in a higher frequency region of the BTSC signal making the stereophonic channel much noisier than the monophonic signal." As a result, the noise of the stereophonic channel dominates the noise added by a BTSC encoder (analog or

digital),, rendering inconsequential the need to reduce or eliminate the self-noise of the analog components comprising it. This fact is not a result of using analog components, but inherent in the nature of the FM transmission system required by the BTSC standard. The present invention does **not** change the transmission system employed for BTSC audio transmissions, but rather changes the nature of the processor which generates the FM signals themselves. Systems of the type described in the present application will generate or receive FM signals which appear essentially identical to those generated or received by analog BTSC equipment – ultimately an analog signal.

The Examiner continues, "Holt teaches that the analog signals are being converted to digital. The rest of the circuitry for providing the conditioned sum signal and for providing the conditioned difference signal processes the digital signals." Certainly some of the claims directed to various aspects of the digital BTSC system of the present application includes digital conversion, as well as "processing" of sum and difference signals. However, except for the relatively trivial matter of forming the sum and difference signals, the proposed digital BTSC system is so different in purpose, technique, and complexity from Holt that it is clear that Holt does not describe the operation of a BTSC system (analog or digital) to reduce noise in an analog transmission path from any possible reading of Holt. Indeed, the differences between Holt and the BTSC system are so great as to make a comparison of the systems invalid.

For example, Holt is designed to improve upon a transmission system described in UK Patent No. 970,051 (hereinafter, "'051", a copy being provided with the Information Disclosure Statement submitted with this response), a "known stereo coding system", which is intended to reduce the bandwidth of an audio signal prior to transmission. This reduction in bandwidth is accomplished by a simple, fixed low-pass filtering of the derived L+R and L-R signals, the intention of which is to reduce or eliminate, at the broadcast side, components of the signal which lie above a particular cut-off frequency. The system improved upon by Holt is, therefore, "single-ended" in that it operates solely on the transmission side of the communications chain to reduce or eliminate those components of the audio signal lying above a certain frequency, and makes no attempt to restore the missing frequency components at the receiver side. The BTSC system, by contrast, maintains all significant frequency components within the audio bandwidth of interest, and delivers them through the receiver intact and with, perceptually, low noise.

In Holt, an element of his teachings may be reducing noise originating from the components of certain analog filters themselves. The BTSC system, on the other hand, is intended to reduce noise induced externally (e.g., in the subcarrier and RF domains), not to reduce noise from internal sources (i.e., the analog components which comprise internal circuitry). To accomplish this, the BTSC system, unlike in '051 or Holt, is "double-ended" so that, as noted in the present application, the "complimentary encoding and decoding insures that the signal-to-noise ratio of the entire stereo audio signal is maintained at acceptable levels." And, unlike Holt, the BTSC system is intended to maintain the full bandwidth of the transmitted audio signal, whether L, R, L+R, L-R, or any point in between.

Holt's teaching involves exclusively simple, fixed-frequency filters: the bandlimiting filter applied to the L-R channel, and the compensating filter applied to the L+R channel. The most essential element of Holt's invention is to match phase delays inevitably introduced by the L-R bandlimiting filter with those introduced by an compensating (all-pass) L+R filter. As Holt points out, and as acknowledged in the preceding text, it is actually far easier to accomplish this matching of phase delays when dealing with digital filters than it is with analog filters.

The Examiner continues, "In view of Fig. 1, one skilled in the art would modify the matrix (110) using a digital adder and subtractor, to modify the difference circuit using a digital difference circuit, and to modify the sum circuit using a digital sum circuit to process the digital input stereophonic signal to be further processed by digital band limiting filter." The Examiner's attention is directed to Holt itself, which the Examiner proposes as providing sufficient prior art for applicant's later digitization of Figure 1 of applicant's invention. Holt itself does not teach modifying "the difference circuit using a digital circuit", or modifying "the sum circuit using a digital sum circuit." This is despite the obvious fact that Holt's subject matter is focused directly on digitizing previously analog functions. It is respectfully submitted that if Holt itself did not anticipate these modifications, it is unreasonable to envision that a later reader who came up with such modifications should have anticipated them through a combination of reference to Holt and the purely analog block diagram of Figure 1 of applicant's invention.

The Examiner's meaning of the terms "digital difference circuit" and "digital sum circuit" are unclear. However, attention is drawn to the fact that each of the rejected claims cites the BTSC standard as an important element differentiating the present invention from the prior art. Clearly, then, the purpose and type of "digital difference circuit" and "digital sum circuit"

must be taken into account in determining whether Holt anticipates the present invention. Given the differences described in the foregoing paragraphs between the operation of '051 (and improved upon in Holt) and the BTSC system, it seems clear that Holt does not anticipate the present invention because one skilled in the art would not be able to deduce the operation of a BTSC system from Holt, nor would the purpose or function of a digital implementation of the BTSC system be obvious from Holt to one skilled in the art at the time the invention was made.

The Examiner then states that, "With a digital stereophonic input source the input could be directly applied to the digital matrix. With analog stereophonic input source (claim 83), one skilled in the art would utilize any well-known ADC to convert the analog signal to digital input to be applied to the digital matrix." It is respectfully pointed out, however, that this limitation provides patentable differentiation from processors which do not include a digitization step.

The Examiner concludes, as noted previously, by stating that, "Thus, it would have been obvious to one of ordinary skill in the art to modify prior art as illustrated in Fig. 1 in view of Holt by implementing Fig. 1 using digital circuitry in order to eliminate the noise caused by the analog circuitry." It is submitted that the Examiner has misconstrued the purposes of the digitization taught in the present invention. As has been pointed out earlier, at no point in the present disclosure is there a claim that the present invention will "eliminate the noise caused by <any> analog circuitry." The original BTSC system, as well as the present invention, reduces noise picked up in analog transmission, caused by the location of the stereophonic [L-R] channel in the FM spectrum. This is not a result of analog components or circuitry, but inherent in the nature of the BTSC system. The present invention does not attempt to band limit the stereophonic [L-R] channel, but instead shows ways to achieve the BTSC system results through a digital system. It is respectfully reiterated that the BTSC system differs so greatly in purpose and operation from Holt, and that the reason for and advantages of a digital implementation of the BTSC system differ in so many fundamental ways from '057 and Holt that one skilled in the art would fail to anticipate one from the other. Nor would the teachings of Holt, when combined with the system shown in Applicant's Fig. 1, make applicant's claimed subject matter obvious.

Moreover, the nature of the digital conversion required to modify Figure 1 of the present application in view of Holt is extensive and not obvious to one skilled in the art. As noted earlier, in order to produce a digital version of a BTSC encoder which would coexist with prior-art versions of BTSC encoders and decoders, inventive skill is required. All the parameters of

the BTSC system were originally defined exclusively in the continuous-time ("s-plane") domain, but a digital version of the BTSC system must be defined in the sampled-time ("z-plane") domain. As is well known to those skilled in the art, the translation from s-plane to z-plane parameter is not straightforward and involves invention if satisfactory results are to be obtained. In this case, significant differences in the phase and amplitude response of the digitally produced BTSC signal from similar signals produced by purely analog means could lead to degradation of the signal upon reception. The BTSC system, as specified in the analog domain, requires in an encoder a minimum of a) one single-order lowpass filter, b) one third-order lowpass filter, c) two rms-level detectors, d) one variable-gain element providing precisely variable gain depending on signal levels as measured by one rms-level detector, e) one variable element providing variable frequency response depending on signal level as measured by the other of the rms-level detectors, f) a second-order high-pass/low-pass filter to precisely mimic the BTSC L-R preemphasis characteristic, g) a first-order high-pass/low-pass filter to precisely mimic the BTSC L+R preemphasis characteristic, h) high-order lowpass filters on both L and R (or L+R and L-R), and i) signal limiters to eliminate overmodulation of the L-R channel. This is much, much more involved than anything taught by Holt. Holt mentions simple, fixed-frequency lowpass filters. Nowhere does Holt mention, let alone teach how to realize an rms-sensing level detector in digital circuitry. Nor does he mention, let alone teach, how to realize a variable gain element, nor one which responds based on the rms-level of a signal. Nor does he mention, let alone teach, how to realize an element offering variable frequency response under any sort of control system, nor one which responds to the rms-level of a signal. Nor does he mention, let alone teach, how to limit a signal to prevent overmodulation.

In order to realize this required, complex system behavior in digital circuitry, and to ensure that the digital circuit emulates the original analog BTSC circuitry with sufficient precision to work compatibly with the prior art required much more than a simple application of basic understanding of digital filters as might be appreciated from a textbook. Instead, it required an appreciation for the complexity which the BTSC system involves, how to precisely map the continuous-time (s-plane) description inherent in the original definition to that of the discrete-time (z-plane) world, and how to trade off different elements of the system against each other in order to create a system which works together properly. All this required more than ordinary skill of one skilled in the art to achieve, even in view of Figure 1 along with Holt.

In section 4, Paragraph 3, the Examiner rejects claim 84, stating, "...the claimed 75 μs preemphasis is inherently included according to BTSC standard." While the ideal BTSC system does employ a 75 μs preemphasis, the inclusion of a specific preemphasis characteristic does create a valid and patentable limitation given that alternate preemphasis characteristics could be used while still adhering substantially to the principles of the BTSC standard.

In Section 4, Paragraph 4, the Examiner rejects claim 85, stating that "the prior art as shown in Fig. 1 shows an adaptive weighting system." The adaptive weighting system referred to by the Examiner is, of course, analog in both construction and operation, while the adaptive weighting system of claim 85 uses digital circuitry. This difference is important because, in the analog domain, an adaptive weighting system is the only practical signal processing which could implement the algorithm required by the BTSC system. In the digital domain, however, other methods become possible (e.g., the use of a look-up table), and the use of an adaptive weighting system becomes an operative limitation. Moreover as described above in more detail,, at the time of the invention of the claimed subject matter defined by claim 85, the translation from an analog adaptive weighting system to a digital version which emulates the prior art analog system was not consider feasible without significant inventive steps described in the present application. Therefore, claim 85 is believed to be allowable..

In section 4, Paragraph 5, the Examiner rejects claims 93 and 105, stating, "...the claimed carrier frequency is inherently included in the modulator as shown in Fig. 1 performed according to BTSC standard." As stated above, the inclusion of a specific carrier frequency does create a valid and patentable limitation given that alternate carrier frequencies could be used while still adhering substantially to the principles of the BTSC standard.

In Section 4, Paragraph 6, the Examiner rejects claim 116, asserting that "with the prior art shown in Fig. 1 modified in view of Holt, the digital output signals are encoded in accordance with the BTSC standard." However, as described in more detail above, in order to modify the inherently analog BTSC system to realize a digital implementation of a BTSC encoder or decoder, much more than a-simple, fixed, digital filter plus a matrix to derive L+R and L-R from L and R is required. As is taught in detail in the subject application and has been covered in detail previously in this response, developing the described embodiment of a digital BTSC system to emulate the essentially analog teachings of BTSC required not only a simple fixed-frequency, fixed attenuation lowpass filter as is taught in Holt, but two time-varying elements: a

variable gain element responsive to measured signal levels to emulate the wideband compander required by BTSC, and a variable frequency-response filter responsive to a different set of measured signal levels. Additionally, the disclosed embodiment of the digital BTSC system requires two signal level detectors responsive to the time-weighted root-mean-square value of certain audio signals represented in the digital domain. These signal level detectors must be filtered through filters which must meticulously emulate the performance of the analog BTSC prototypes. Finally, the entire disclosed system of L-R processing must be designed to conform to the performance of the overall analog BTSC prototype. This requires careful filter and system design to ensure success in the required emulation. This is a difficult and sophisticated task today, let alone in the context at the time the invention was made. It appears that the Examiner has made the assumption that the jump from analog BTSC, in light of Holt, is a simple one that does not require significant inventive material. This is simply not the case.

As a result, we respectfully submit that the Examiner's rejection is not supportable since Holt taken with applicant's Fig. 1 neither anticipates not makes obvious applicant's invention..

In Section 4, Paragraph 7, the Examiner rejects claims 117 and 119 by stating that "with the prior art showing in Fig. 1 modified in view of Holt, the generated output signals are BTSC encoded digital output signals." As with claim 116, and as described in more detail above, the "modification" of the system in view of Holt is a leap that even one quite skilled in the art would find difficult and complex. Holt does not suggest or teach any approach for going from the prior analog BTSC system (as shown in Fig. 1 of the present application) to a digital BTSC system.

In Section 4, Paragraph 8, the Examiner rejects claim 120 on the grounds that, "...the prior art as shown in Fig. 1 shows an encoder, with the prior art modified in view of Holt, the first and second digital filter sections are configured as part of the encoder."

The Examiner's attention is drawn to the fact that, as shown throughout, Holt does not teach anything about a BTSC system, whether implemented using analog or digital construction.. More specifically, Holt does not disclose a digital adaptive signal weighting system whose gain and phase characteristics change dynamically with signal content. Further, Holt's teachings are directed towards serving the needs of a digital transmission system, not those of the analog transmission system employed by the BTSC system, regardless of whether the BTSC system was realized in analog or digital form.

Even further, the BTSC system comprises both encoder and decoder elements, both of which comprise first and second digital filter sections to alter gain and phase characteristics of signals. Therefore, limiting the scope of the independent claim 111 to encoders, as is done in dependent claim 120, should be deemed valid and patentable.

In Section 4, Paragraph 9, the Examiner rejects claims 60, 63, 64, 67, 68, 69, 71-73, and 76-81 by stating that "the prior art as shown in Fig. 1 intends to use an analog modulator to combine the conditioned sum signal and the conditioned difference signal to generate the composite signal to transmission. The same analog modulator could be used even though the conditioned sum signal and the conditioned difference signal are in digital format." The Examiner continues,

> One skilled in the art would use DACs to convert the conditioned sum signal and the conditioned difference signal respectively before applying them to the modulator. On the other hand, the conditioned sum signal and the conditioned difference signal could be combined using well-known digital modulator before being converted to analog format for transmission. Either way, they would generate the composite broadcast signal. Thus, it would have been obvious to one of ordinary skill in the art to modify the prior art as shown in Fig. 1 in view of Holt by utilizing well known DACs to convert the digital conditioned digital sum signal and the conditioned digital difference signal in order to use the analog modulator as intended to be used by the prior art as show in Fig. 1 or using well-know digital modulator for combining the conditioned sum signal and the conditioned difference signal in order to use the analog transmission as intended to be used by the prior art as shown in Fig. 1.

It is respectfully pointed out, however, that based on the previous discussion, the digital BTSC processor as described in the present application is not anticipated nor made obvious by the prior art cited and applied by the Examiner. Further, the conditioned sum and conditioned difference signals as derived in a digital BTSC encoder or decoder are very different from the superficially similar signals shown in Holt. The conditioned difference signal, in particular, has a very different spectral and dynamic content as a result of the wideband and spectral encoding described in the present invention and which, among other aspects, significantly differentiates the present invention from Holt. That Holt converts certain digital signals to the analog domain cannot be considered to anticipate conversion of BTSC signals from digital to analog as in the present invention when the latter are so different in spectral content and format. To do otherwise would be to view Holt as anticipating any claim element that provides for digital to analog

conversion. Even further, in the earliest digital BTSC implementations, conversion to analog occurred only after combining the conditioned sum signal and the conditioned difference signal. Doing so prior to combining these signals was certainly not obvious.

As well, Holt does not anticipate the use of a digital modulator to combine and modulate the superficially similar signals in his invention, either in Fig. 1 or elsewhere. The use of a digital modulator to combine and modulate BTSC signals was not a practice at the time of the invention and took real inventive steps to implement.

In Section 4, Paragraph 10, the Examiner rejects claims 62, 66, 71, and 75 because "the claimed 'preselected sample rate' is inherently included in a digital signal." Certain digital signals – simulators, for example, that are run in a non-real-time mode – cannot be said to have a 'preselected sample rate'. The foregoing claims, therefore, are legitimate limitations to the scope of the claimed subject matter, and provide proper claim differentiation..

Further, claims 66 and 75 recite a different preselected sample rate for the L+R path versus the L-R path, an element that is not 'inherent' or obvious in this specific implementation. Certain systems might alter the sample rate dynamically, based on signal content. With these considerations in mind, it is submitted that the claimed 'preselected sample rate' represents a valid and patentable limitation.

In Section 4, Paragraph 11, the Examiner rejects claims 61, 65, 70, 74, 90, and 91, stating that

> although Holt fails to show DSP, Holt suggests the digital circuitry for perform [sic] the calculation necessary to condition the sum and difference signals. The prior art as shown in Fig. 1 indicates the numerous calculation are required to condition the sum and difference signals. A DSP, as well known to those in the art, would be able to efficiently and rapidly perform the calculations on digitized signals that were originally analog in form. The big advantage of the DSP lied in the programmability of the processor, allowing parameters to be easily changed. Thus, it would have been obvious to one of ordinary skill in the art to modify the prior art as shown in Fig. 1 in view of Holt by using a DSP and programming the processor to perform the functions as required for conditioned [sic] the difference signal in order to efficiently and rapidly providing the conditioned difference signal.

It is submitted that the use of DSP to implement a BTSC encoder or decoder would not be obvious. In particular, a DSP configured to emulate certain of the highly non-linear analog functions required for implementing the BTSC processing operations is not at all obvious,

particularly at the time of the invention and given the then-current state-of-the-art in digital signal processing technology. Without the expert knowledge required to use a DSP in this application, one would most likely consider that a combination of analog and digital components would be the most obvious method for implementing a practical BTSC device. Only with significant knowledge into the means for emulating the more complex analog functions, combined with expert insight into how a DSP might best be exploited in a cost-effective way, would a DSP be usable to construct a BTSC processor. Certainly Holt provides no such expert knowledge or insight, and therefore the Examiner's position that Holt makes the use of DSP obvious in this case does not seem to be supported.

In Section 5, the Examiner responds to arguments submitted to the response filed on May 29, 2007. While Examiner's review is greatly appreciated, Applicant believes that the Examiner's responses do not adequately rebut the points made in the original response. In particular,

In Section 5, Paragraph 2, the Examiner states that,

> On p. 24, applicant argues that at 1996, the year the present application was filed, the digital conversion of the conditioned sum and difference signals prior to modulation was not straight forward. Examiner would like to point out that the article by Todd was published in 1987, nine years prior to the filing of the present invention. At 1987, Todd already disclosed digital BTSC encoder to deliver digital audio. Technology advanced for nine more years. It is irrelevant whether the DSP was still a relatively new and expensive technology. As long as another inventor(s) made the invention before the applicant, then the present invention is not patentable.

We respectfully point out that these conclusions reflect an underlying misunderstanding of the prior art with respect to the applicant's claims. As was pointed out previously, Todd emphatically does not disclose a digital BTSC encoder. Todd begins his article "The BTSC multichannel television sound system (ref. 1), which is being adopted by some U.S. broadcasters, is based on analog techniques." His reason for stating this is not to then propose a digital version of BTSC, but to propose an alternative digital transmission system that would exist *alongside* the analog BTSC system. This can be seen throughout the paper. For example, the heading on p. 298 reads "II. Outline of a New Digital Sound System" and the following text states, "The most important requirement for the new system is compatibility. The new digital carrier must not interfere with the existing vision or sound signals." The existing sound signals referred to are, of

course, the existing BTSC signals. This is made clear later in the first paragraph where Todd states, "There is potential for interference [from this new digital system] into the video, and into the [existing, analog] BTSC sum, difference, and SAP channels..."

Todd goes on, in his section IV entitled "BTSC Compatibility Tests", to ensure that the new digital system does not interfere with the operation of the BTSC system. This is clear from the first line which states, "As previously mentioned, the effect of the new digital signal on the BTSC audio will be one of additive noise." The Examiner's attention is drawn to the fact that Todd does not attempt to distinguish between a "digital" BTSC system and an "analog" BTSC system, but rather between a "new digital system" and "BTSC audio", making it exceedingly clear that his (Todd's) system is not a version of BTSC at all. With this in mind, we respectfully submit that the Examiner's rebuttal is not supported.

The Examiner goes on to say, "On p. 25, applicant argued that the processing requirements of a BTSC encoder made it impossible to implement the encoder on a single Motorola 56002." The Motorola 56002 was cited as the state of the art at the time the application was filed in 1996. The only claim that specifies a single IC is claim 90. It is noted that claim 90 does not claim a single Motorola 56002. Furthermore, claim 90 specifies the elements on the single IC are the digital matrix unit, the difference channel processing unit, and the sum channel processing unit. The digital matrix unit is simply an adder and a subtractor to produce L+R and L-R respectively. The difference channel processing unit and the sum channel processing unit could be broadly interpreted as any element that process L+R and L-R. The element could be a buffer, a filter to eliminate noise, a capacitor, an inductor, a combination of capacitor and resistor and so on. A simple buffer or a filter does not require any sophisticated processing, so it does not require a lot of space on a single IC. The term 'encoded digital difference channel signal' is met after the digital difference channel signal is processed. One skilled in the art would have expected that a single IC could contain the claimed digital matrix circuit, the difference channel processing unit and the sum channel processing unit."

It should be appreciated that the difference channel processing unit is quite complex. The term "difference channel processing unit" should not be so broadly interpreted as to encompass a simple buffer or filter as the Examiner has indicated. In fact, the "difference channel processing unit" provides the complex signal processing required to process the L-R signal according to the BTSC standard.

As made clear in the specification, and further established earlier in this response, BTSC encoding and decoding requires sophisticated digital signal processing and significant ingenuity to implement . At the time of the invention, digital BTSC processors had not been implemented digitally at all, much less as a single IC. Therefore, it is submitted that the implementation of a BTSC encoder or decoder as a single integrated circuit does, indeed, represent an inventive and patentably distinct claim.

Going on, the Examiner states that, "On p. 25, applicant argued that it is difficult at the time of the present invention was made to create a modulator. Todd, at 1987, discloses how to use a QPSK modulator to generate a composite signal to deliver digital audio signal to TV."

While Todd discloses a QPSK modulator for delivering digital audio signals to a TV, the term "modulator" has many meanings as a term of art. The BTSC system, in particular, does not use QPSK modulation, nor is the modulator of the present invention used to transmit digital information as with Todd. It is respectfully submitted, therefore, that the use of a digital modulator to provide double-sideband-suppressed-carrier amplitude modulation as described in the present invention and solely in the context of the BTSC system was not anticipated by Todd.

The Examiner then states that

> On p. 26, applicant argued that present invention performs amplitude modulation of a digital subcarrier by a digital BTSC signal. However, the specific [sic] of the amplitude modulator of a digital subcarrier by a digital BTSC signal is not in the claim. It is irrelevant [to] what is being disclosed in the specification.
>
> On p. 27, applicant argued that the present invention as specified in claim 115 specifically recites that the digital composite modulator is positioned in the same path as the BTSC encoder. As shown in Fig. 5 of Todd, the BTSC encoder is in the same path as the digital composite modulator. The output from the modulator is responsively [sic] and as a function of the encoder.

Referring to Fig. 5 of the Todd article, it clearly shows that the QPSK modulator (which the Examiner has explained is the modulator referenced by Todd) is most certainly not in the same path as the BTSC Encode block. The QPSK Mod block and the BTSC Encode block both feed the (entirely separate and irrelevant to this discussion) RF modulator block labeled "Ch3 Mod", but they do so by way of parallel and completely separate paths. Has the Examiner confused the "Ch3 Mod" block with the "QPSK Mod" block? The Examiner's attention is directed to Fig. 5 of Todd.

The Examiner continues,

> On p. 28, applicant attacked Holt alone by stating that Holt does not teach anything about the BTSC method, and present invention transmitted and received signals that are analog over the intermediate medium. First of all, the rejections are based on the prior art as shown in Fig. 1 in view of Holt, not Holt alone. Examiner does not state that Holt teaches a BTSC method, Holt teaches the benefit of transmitting digital audio signal for TV broadcasting. The claims do not specify that the analog signal is transmitted and received over the intermediate medium. Holt might solve a different problem form the present invention as disclosed in the specification, but it is irrelevant. It is the claimed invention that is being rejected.

As noted earlier, this may be the point around which the Examiner is confused. It seems the Examiner believes the present application is directed towards transmission and reception of a digital signal. Nothing could be further from the truth. The BTSC signal transmitted and received under the present application is purely analog. The signal transmitted and received by Holt is, as the Examiner correctly notes, a digital signal.

The present disclosure and claimed subject matter provides a way, using digital components, of creating an analog BTSC signal that is, other than with the improvements described with respect to stereo separation, component drift, etc., entirely equivalent to the conventional analog BTSC signal. It is not the output signal itself that is different at all, but only the specifics of how it is developed. While "Holt teaches the benefit of transmitting digital audio signal for TV broadcasting." the present application teaches the benefit of using digital technology to create a 'better' version of an analog audio signal for TV broadcasting.

The Examiner goes on to state that, "From the lower half of p.29 through the upper half of p. 30, applicant argued that it is very difficult to implement digital adaptive signal weighting system at 1996. Well, 9 years ago, Todd discloses the digital BTSC encoder, which encodes the signals according to BTSC standard that includes adaptive weighting system."

Once again, applicant suggests that the Examiner re-inspect the Todd article because it most certainly does not disclose a digital BTSC encoder. Todd discloses an entirely different digital audio system whose signals are intended to be transmitted alongside of a BTSC signal. It should also be pointed out that based upon applicant's knowledge the Todd system has not been used in a single commercial broadcast or implemented in a single TV set, whereas the use of digital technology to encode and decode a BTSC signal as disclosed in the present application

has been widely adopted under licenses from the applicant.. See the supporting Declaration under 37 C.F.R. § 1.132.

Support Declaration of Leslie B. Tyler

In further support of the patentability of the claims now pending in the application, applicant is submitting a Declaration of Leslie B. Tyler, CEO and President of the assignee of the present application. The Declaration is intended to demonstrate the commercial success of the invention now being claimed.

Claims 60-93 and 104-120, directed to the elected invention, are all considered allowable over Todd, Fig. 1 of the present application, and Holt et al. An early and favorable action thereon is therefore earnestly solicited.

No further fees are believed due; however please charge any fees which may be due, or credit any overpayment, to Deposit Account Number 50-1133.

Respectfully submitted,

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